

REMARKS

I. Introduction

By the present amendment, claims 1, 10, 13, and 20 have been amended. No claims have been added or cancelled. Accordingly, claims 1-20 remain pending in the application. Claims 1, 10, and 20 are independent.

II. Rejections Under 35 USC §102

In the Office Action of May 17, 2005, claims 1-20 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent 6,531,843 issued to Iwaji et al ("Iwaji"). Regarding this rejection, the Office Action alleges that Iwaji discloses a driving system of an AC motor which includes all of the elements recited in the pending claims. With respect to independent claim 1, for example, the Office Action indicates that Iwaji discloses a ripple current generator for supplying a ripple current to the AC motor, and a magnetic pole position estimator where the magnetic pole position estimator observes at least two current values of the ripple current to estimate the magnetic pole position of the AC motor. Reference is directed to various passages from Iwaji.

As amended, independent claim 1 defines an AC motor control apparatus comprising a controller which sends a control signal to an inverter which supplies arbitrary AC power to an AC motor. The controller comprises:

a ripple current generator for supplying a ripple current to said AC motor; and

a magnetic pole position estimator,
wherein said ripple current generator outputs a voltage
command V_{hd}^* , and
wherein said magnetic pole position estimator receives
said voltage command V_{hd}^* , an exciting current component I_{dc}
of a motor current, and a torque current component I_{qc} of said
motor current as input, and said magnetic pole position
estimator outputs a position error $\Delta\theta$ to estimate the magnetic
pole position of said AC motor.

According to independent claim 1, the controller of the AC motor control apparatus includes a ripple current generator that supplies a ripple current to the AC motor and a magnetic pole position estimator. The ripple current generator outputs a voltage command (V_{hd}^*) to the magnetic pole position estimator. In addition, the magnetic pole position estimator also receives an exciting current component (I_{dc}) of the motor current, and a torque current component (I_{qc}) of the motor current as input. The magnetic pole position estimator then outputs a position error $\Delta\theta$ to estimate the magnetic pole position of the AC motor. Accordingly, the position error, $\Delta\theta$, is estimated based on the three values input to the magnetic pole position estimator. The position error can, for example, be output to a gain corrector according to one or more embodiments of the invention. This particular feature is illustrated, for example, in Figs. 1, 8, and 11 of the present application. At least one benefit achieved by the invention defined in independent claim 1 is that the accuracy with which the position error $\Delta\theta$ can be estimated is enhanced without interference from inductance variations resulting from the stator of the motor. See page 11, lines 1-3 of the present application.

The Office Action alleges that Iwaji discloses all of the elements of the claimed invention. As amended, however, Iwaji fails to disclose the elements recited in independent claim 1. Iwaji discloses a driving system for an AC motor that includes, in part, a magnetic pole position estimator which calculates an error between the magnetic pole position of the motor and estimated magnetic pole position. The error appears to be calculated in a manner that is clearly different from that set forth in independent claim 1.

Review of Iwaji suggests that the magnetic pole position estimator does not calculate the error based on the three inputs, as recited in independent claim 1. In other words, the error is not calculated based on the voltage command (V_{hd}^*), the exciting current component (I_{dc}), and the torque current component (I_{qc}). While the magnetic pole position estimator of Iwaji appears to utilize various quantities as input to estimate the error, it never discloses or suggests the specific combination of inputs set forth in independent claim 1. For example, Fig. 6 of Iwaji illustrates only a minute voltage change and a current detection value as input to the magnetic pole position estimator. There is simply no disclosure or suggestion in Iwaji for supplying (as input to the magnetic pole position estimator) a voltage command (V_{hd}^*), an exciting current component (I_{dc}), and a torque current component (I_{qc}) to the magnetic pole position estimator, as set forth in independent claim 1.

It is therefore respectfully submitted that independent claim 1 is allowable over Iwaji.

Claims 2-9 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

Independent claim 10 defines an AC motor control apparatus that comprises a controller which sends a control signal to an inverter which supplies arbitrary AC power to an AC motor. The controller comprises:

- a ripple current generator for supplying a ripple current to said AC motor; and
- a magnetic pole position estimator,
wherein said ripple current generator outputs rectangular waveform voltages with different amplitudes in sequence as a voltage command V_{hd}^* and said magnetic pole position estimator receives said voltage command V_{hd}^* , an exciting current component I_{dc} of a motor current, and a torque current component I_{qc} of said motor current as input, and said magnetic pole position estimator outputs a position error $\Delta\theta$ to estimate the magnetic pole position of said AC motor.

Similar to independent claim 1, the magnetic pole position estimator of independent claim 10 receives, as input, a voltage command (V_{hd}^*), an exciting current component (I_{dc}), and a torque current component (I_{qc}). The magnetic pole position estimator subsequently outputs a position error to estimate the magnetic position of the AC motor. As previously discussed with respect to independent claim 1, the art of record simply fails to either disclose or suggest a magnetic pole position estimator that outputs a position error based on these three inputs.

It is therefore respectfully submitted that independent claim 10 is allowable over the art of record.

Claims 11-19 depend from independent claim 10, and are therefore are believed allowable for at least the reasons set forth above with respect to independent claim 10. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

Independent claim 20 defines an AC motor control apparatus that comprises a controller which sends a control signal to an inverter which supplies arbitrary AC power to an AC motor. The controller comprises:

- a ripple current generator for supplying a ripple current to said AC motor; and
- a magnetic pole position estimator,
wherein said ripple current generator outputs a stepwise waveform voltage as the voltage command V_{hd}^* or outputs rectangular waveform voltages with different amplitudes in sequence as a voltage command V_{hd}^* and said magnetic pole position estimator receives said voltage command V_{hd}^* , an exciting current component I_{dc} of motor current, and a torque current component I_{qc} of said motor current as input, and said magnetic pole position estimator outputs a position error $\Delta\theta$ to estimate the magnetic pole position of said AC motor.

Similar to independent claim 1, independent claim 20 includes a magnetic pole position estimator that outputs a position error to estimate the magnetic pole position of the AC motor based on a voltage command (V_{hd}^*), an exciting current component (I_{dc}), and a torque current component (I_{qc}). Again, this particular feature is not shown or suggested by the art of record.

It is therefore respectfully submitted that independent claim 20 is allowable over the art of record.

III. Conclusion


For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

To the extent necessary, Applicants petition for an extension of time under 37 CFR §1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (Case No. 1021.43549X00) and please credit any excess fees to such deposit account.

Respectfully submitted,
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Dated: November 16, 2005